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LOW-INCOME ADULTS FOOD MANAGEMENT PRACTICES AND NUTRITION BEHAVIORS AND THE ASSOCIATION WITH DIET

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THESIS

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Science in the
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By

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ABSTRACT OF THESIS

LOW-INCOME ADULTS FOOD MANAGEMENT PRACTICES AND NUTRITION BEHAVIORS AND THE ASSOCIATION WITH DIET

Food insecurity and diet quality are concerns in low-income populations, contributing to high rates of obesity. Food management skills may enable low-income populations to obtain a healthy food supply rather than relying on less expensive and less nutritious foods to fill their diets. The purpose of this study was to assess the relationship between food management practices and diet quality in SNAP-ED/EFNEP participants. This study examines the association between food management behaviors and dietary outcomes (Healthy Eating Index totals, total calories, carbohydrates, protein, fat, and fiber, and servings of fruits, vegetables, milk, and meats/beans) as measured by the Behavior Checklist and diet information collected by Extension Program assistants for 1,585 participants in Kentucky counties (n=57) during 2010-2011. The results of the cross-sectional analysis suggest that food management practices can help low-income SNAP-ED and EFNEP participants obtain more food for their families. However, diet quality was only improved for the variable 'healthy foods,' (participants who responded that they thought about healthy foods when deciding what to feed their families). It was concluded that an integrated approach of food management practices and nutrition education is needed to improve diet quality for low-income populations.

KEYWORDS: SNAP-ED, EFNEP, Food Management, Diet Quality, Low-income

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Chapter One: Introduction

The prevalence of obesity has increased in our nation over the past three decades with two-thirds of American adults currently classified as overweight or obese. (Flegal Km, 2012). Conversely, about 15% of households in the US are food insecure (USDA, 2012). Taken together, these findings suggest that those who experience high rates of food insecurity also experience high rates of obesity (Townsend et al., 2001, Tanumihardjo et al., 2007, Townsend, 2006, Drewnowski, 2009, Satia, 2009). Thus, the obesity paradox was coined to refer to the fact that hunger and obesity exist side by side in our nation, especially in the lower income populations (Dietz, 1995). Since obesity is associated with energy imbalance (consuming more calories than expended) and hunger is associated with not having access to enough food, the states can appear to be unrelated. The association between food insecurity and overweight or obesity has been shown in research (Townsend et al., 2001, Drewnowski and Specter, 2004, Drewnowski, 2009, Jilcott et al., 2011, Tanumihardjo et al., 2007, Townsend, 2006, Wang and Zhang, 2006). It is plausible that filling, high-fat, high-sugar/carbohydrate foods are consumed to prevent hunger when food is limited (Dietz, 1995). Furthermore, since food insecurity is more prevalent in low-income populations and cost is a large factor when choosing foods, it is proposed that less expensive energy-dense foods are often chosen over more costly nutrient-dense foods (Drewnowski, 2004, Darmon and Drewnowski, 2008, Beydoun and Wang, 2008, Monsivais and Drewnowski, 2009, Drewnowski and Specter, 2004).

Justification

Food insecurity and diet quality are concerns in the low-income population, since energy-dense foods tend to be less expensive than nutrient-dense foods (Drewnowski,

2004). Programs such as The Supplemental Nutrition Assistance Program- Education (SNAP-ED) and The Expanded Food and Nutrition Education Program (EFNEP) strive to optimize dietary scores in low-income participants through teaching them the skills they need to make healthy choices and provide healthy meals for their families. The goal of these programs is to provide nutrition lessons for low-income participants to encourage them to make healthy choices, and supplement their limited budget. Nutrition education is delivered to groups or individuals receiving the assistance. However, lessons on food management skills are currently optional and at the discretion of the EFNEP/SNAP-ED program assistants. While a few tips for food management are included in the regular lessons, in-depth lessons may not be used. Learning food resource management practices may enable low-income populations to make the most of their food supply and ensure that their families receive wholesome meals on a regular basis. Good food management practices may be a way to teach low-income populations how to strategize to plan nutritious meals and purchase healthy foods rather than relying on less expensive and less nutritious foods to fill their diets.

Statement of Purpose

The purpose of this study was to assess the relationship between good food management practices and diet quality in SNAP-ED and EFNEP participants. This study examines the association between food management behaviors and dietary outcomes (Healthy Eating Index totals, total calories, carbohydrates, protein, fat, fiber, servings of fruits, vegetables, milk, and meats and beans) as measured by the Behavior Checklist and diet information collected by Extension program assistants for 1,585 participants in the

2010-2011 year. The hypothesis is that those who practice more healthy food management habits will have better dietary outcomes.

Research Aims

1. Determine the association between food management behaviors and dietary scores among SNAP-ED and EFNEP participants.
2. Determine the association between food management practices and dietary quality (as measured by the Healthy Eating Index).

Assumptions

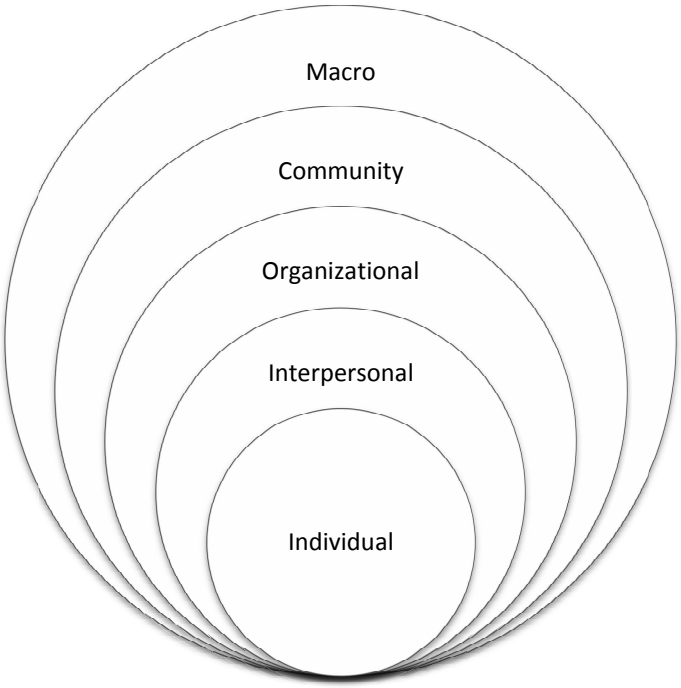
The following assumptions were made: first, it was assumed that dietary variables were reported correctly by participants, and accurately measured and recorded by SNAP-ED/EFNEP program assistants. Secondly, it was assumed that participants accurately responded to the Behavior Checklist questionnaire.

Chapter Two: Literature Review

Socioecological Model

The ability and decision to make healthy food choices is influenced by many factors (French et al., 2001). The socioecological model explains the complex correlations that exist between an individual and their environment at several different levels (Gregson et al., 2001). On the most basic level, an individual's knowledge, skills, preferences, attitudes, lifestyle, genes, gender, age, and demographics can affect one's eating behavior. An individual must not only possess the knowledge about how to eat, but also must have the skills to prepare the food, the time and desire, and the means and accessibility to purchase nutritious foods.

Figure 1 - The Socioecological Model



On an interpersonal level, family, peers, and social networks can affect the way a person views the world and the decisions he or she makes. On a broader level, the institutional or organizational sphere of influence relates to the policies or rules and regulations of places of work, religious associations, and other networks or organizations. The community level can influence the individual through its social norms and standards. This includes one's home, work, school, neighborhood, restaurants and food stores available. On the broadest level is the macro-level environment, which includes social structure, policy and systems. In this level, factors that could influence eating behavior would be the culture and social norms in which one lives, the marketing and media that one is influenced by, the government policies that may affect nutrition and available information, the food assistance programs, health care, and the food industry at large (Story et al., 2008). The socioecological perspective can provide a useful framework in understanding the influences of eating behavior and can be used in order to plan an effective nutrition intervention (Story et al., 2008). However, a dietary change in the individual can only come about when the environment provides sufficient access to nutritious yet affordable foods (Story et al., 2008).

Obesity

The Socioecological Model can also be used to examine environmental factors that may have influenced the obesity epidemic in our nation. Obesity rates have become a crisis in the United States, affecting every region, state, community, and school in our nation. Obesity is defined as having a Body Mass Index of 30 or greater, and is calculated by dividing weight (in kilograms) by height in meters squared (CDC, 2011). According to the Centers for Disease Control and Prevention, the prevalence of childhood obesity in

the United States has more than tripled in the past thirty years (CDC, 2011). In recent years, obesity trends have remained steady, with slight increases (Flegal Km, 2012, Main Ml, 2010). In 2009-2010, obesity rates among American men were 35.8% and 35.5% among American women (Flegal Km, 2012). Furthermore, low-income populations have been shown to suffer from higher rates of obesity (CDC, 2011, Wang and Zhang, 2006, Ogden et al., 2002, Flegal Km, 2012). The determinants of obesity are multifactorial and cannot be singled out by one lifestyle or environmental factor. However, in recent decades, trends in the food environment are suggested to be associated with the rise in obesity rates (French et al., 2001, Popkin et al., 2005). American citizens today tend to live a faster paced life, demanding convenience and ease. There has been an increase in the consumption of food prepared outside the home, especially from fast-food chains (French et al., 2001, Jeffery and French, 1998, Bowman and Vinyard, 2004). These foods tend to be higher in calories and fat, and served in larger portion sizes than foods prepared in the home (Rolls, 2003, Jeffery and French, 1998, Bowman and Vinyard, 2004). Increased food intake and less physical activity promote the obesity crisis that has spread across our nation (French et al., 2001, Jeffery and French, 1998).

SNAP-ED and EFNEP

Alongside the obesity epidemic in the United States, there is also food insecurity. Food insecurity is present when "the availability of nutritionally adequate and safe foods or the ability to acquire acceptable foods in socially acceptable ways is limited or uncertain" (Anderson, 1990)(p 1560). The Supplemental Nutrition Assistance Program (SNAP) and the Expanded Food and Nutrition Education Program (EFNEP) are two government programs designed to reduce food insecurity and provide low-income

populations access to a nutritious and affordable diet. They aim to provide their clients with the skills and knowledge they need in order to make healthy changes in life and to improve their nutrition status. SNAP, formerly called the Food Stamp Program, was originally developed to allocate extra commodities during the Great Depression. As our nation's largest food and nutrition assistance program, SNAP has been called, "the cornerstone of the nation's nutrition safety net," (Landers, 2007)(p.1945). It is an entitlement program, meaning that anyone who meets the criteria for eligibility can receive the benefits. The Food Stamp Program began providing nutrition education to its clients in 1981, after Congress passed an amendment to the Food Stamp Act of 1977. The amendment stated that food and nutrition education would be provided for its participants to encourage the purchase and consumption of nutritious foods (Landers, 2007).

Unlike SNAP, EFNEP does not actually deliver direct food assistance to its clients, but assistance in the form of nutrition education and referrals. EFNEP is designed to help low-income families, and is an educational approach to dealing with food insecurity (Leidenfrost, 2000). It is comprised of a series of educational lessons presented to individuals or groups of participants by the extension program assistants. These lessons provide the knowledge and skills for participants to make positive behavior changes and improve their lifestyles.

Food-Insecurity and Obesity

Low-income populations have less ready access to nutritious foods, making it more difficult for them to meet their daily nutritional requirements (Baker et al., 2006, Goodwin et al., 2006, Satia, 2009). Diet-related health disparities are defined as, "differences in dietary intake, dietary behaviors, and dietary patterns in different

segments of the population resulting in poorer dietary quality and inferior health outcomes for certain groups and an unequal burden in terms of disease incidence, morbidity, mortality, survival, and quality of life" (Satia, 2009)(p.2). Socioeconomic factors, especially income and education levels, have been suggested as the strongest contributors to diet-related disparities, even more so than race and ethnicity (Satia, 2009, Drewnowski and Specter, 2004, Goodwin et al., 2006). A person's income may determine whether or not an individual can afford to purchase nutritious foods, while a person's education level may determine the extent of knowledge and competency when it comes to making healthy choices.

Food insecurity can not only lead to hunger and under-nutrition, but also over-nutrition and obesity (Tanumihardjo et al., 2007, Drewnowski and Specter, 2004). The obesity paradox was first proposed by researcher Deitz in 1994 when he suggested that, "food choices or physiologic adaptations in response to episodic food shortages could cause increased body fat" (Dietz, 1995)(p.767). Obesity is disproportionately represented in the low-income populations, regardless of race or ethnicity (NHANES, 2012). Other studies have observed the higher representation of obesity in the low-income and lower education populations (Drewnowski, 2004, Darmon et al., 2003, Drewnowski and Specter, 2004).

Disparities related to income have been shown to have a greater outcome on diet quality than total energy intake (Drewnowski and Specter, 2004, Darmon and Drewnowski, 2008, Beydoun and Wang, 2008, Monsivais and Drewnowski, 2009, Wiig Dammann and Smith, 2009). Higher diet quality scores have been associated with increased income and educational levels, and lower diet quality scores with low income

and education levels (Drewnowski and Specter, 2004, Guo et al., 2004, Bowman et al., 1998, Beydoun and Wang, 2008, Darmon and Drewnowski, 2008, Monsivais and Drewnowski, 2009). Low-income status has been shown to decrease fruit and vegetables consumption, which decreases diet quality (Darmon and Drewnowski, 2008, Nicklas et al., 2001, Monsivais and Drewnowski, 2009, Darko et al., 2013, Turrell and Kavanagh, 2006). Low-income individuals have been shown to be less likely to purchase foods that are high in fiber, and low in sodium, fat, and sugar (Turrell and Kavanagh, 2006, Turrell et al., 2009).

A large contributor to this issue could be food costs. Drewnowski found an inverse relationship between the energy density of foods and their costs. Diets richer in added fats and sugar, refined grains, and processed foods were found to be more affordable than diets rich in nutrient-dense foods such as fruits, vegetables, leans meats, and whole grains (Drewnowski, 2004, Drewnowski et al., 2007). Factors such as taste, convenience, and the desire to reduce diet costs were also identified as contributors leading to the purchase of energy-dense foods (Drewnowski, 2004, Drewnowski, 2010). Low cost diets are associated with low quality, energy density (Drewnowski, 2004, Drewnowski, 2010, Drewnowski and Darmon, 2005, Schroder et al., 2006, Monsivais and Drewnowski, 2009). Because of this, Drewnowski suggested that the obesity epidemic in America is largely an economic issue. If this is so, then utilizing good food management practices is a key step to ensuring a nutrient-dense diet on a regular basis for low-income populations.

Healthy Eating Index

The Healthy Eating Index (HEI) is used to evaluate program effectiveness in both SNAP-ED and EFNEP participants. The Healthy Eating Index was developed by the USDA Center for Nutrition Policy and Promotion in 1995 (Bowman et al., 1998). It is a tool used to measure diet quality when compared with the dietary guidelines, which are designed to reduce risk factors for chronic diseases and improve overall health and nutrition status. The Healthy Eating Index is a scale from 0 to 100, and is designed to tell how well a person's diet corresponds with the dietary guidelines and to measure the variety, balance, and moderation within the diet (Bowman et al., 1998). There are ten components of the Healthy Eating Index, which are meant to represent aspects of a nutritious diet. The first five components measure the intake of fruits, vegetables, grains, meat and beans, and milk. These components are compared to daily recommendations and can contribute a maximum score of 10 points each towards the total HEI score. The sixth component is total fat, which measures total fat as a percentage of total calorie intake. The seventh component is saturated fat as a percentage of total calorie intake. Component eight measures total cholesterol consumption and component nine measures total sodium intake. The tenth component measures the variety in the individual's diet. Each component can contribute up to ten points to the overall HEI score. The full ten points are given for each of the food group components if the recommended number of servings was consumed based on the individual's age and gender. If no servings were consumed a score of zero was given in that component. Ten points were given if total fat was ≤30% of total energy, saturated fat was ≤10% of total energy, cholesterol was ≤300 mg, and sodium was ≤ 2.4 g. A score of zero was given if total fat was ≥45% of total

energy, saturated fat was ≥15% of total energy, cholesterol was ≥ 450 mg, and sodium was ≥ 4.8 g. For the diet variety component, ten points were rewarded if ≥8 different food items were consumed per day. A score of zero would be given in the variety component if three or fewer food items were consumed per day. Between the highest and lowest scores, points were rewarded proportionally (Guenther et al., 2008). A score between 0 and 50 indicates a poor diet. A score between 51 and 80 indicates that the diet needs improvement, and a score between 81 and 100 represents a good diet (Guo et al., 2004). The higher the HEI score for a diet, the more that diet complies with the recommendations by the USDA.

A trained Cooperative Extension program assistant collects 24-hour dietary recalls from each participant. Aids such as food models, charts, and measuring cups are used to assist with food recall for type and amount. To help with the recall of commonly forgotten items, such as condiments, fast foods, and accompaniments, special probes are used. Food serving amounts are calculated from food consumption data using the food serving assumptions from USDA's Food Guide Pyramid. The nutritive value of foods was checked, and Nutrition Software (NutWin) was used to quantify dietary intake of total calories, fat, carbohydrates, and protein (NutWin, 2012). These data are used to calculate HEI scores.

The Healthy Eating Index was validated with the use of plasma biomarkers (Hann et al., 2001). Hann et al (2001) collected three day food records from 340 women who were the subjects in a case-control study examining breast cancer and diet. HEI scores were calculated for the food records and blood samples were taken to measure plasma biomarkers. Higher HEI scores were significantly associated with higher plasma levels of

β-carotene, α-carotene, lutein, β-crptoxanthin, and vitamin C. It was concluded that the Healthy Eating Index is a reliable tool for evaluating the overall diet, and that it has the potential to be useful in nutritional epidemiology (Hann et al., 2001). The Third NHANES was also used to further validate the Healthy Eating Index, as well as highlight its potential in epidemiological studies (Weinstein et al., 2004). Lab data and HEI scores were taken from the Third NHANES (1988-1994) participants to examine the correlation between blood nutrient concentrations and HEI score levels. Positive correlations were found for serum and red blood cell folate values, serum vitamin C and E, and the carotenoids (except lycopene). Serum folate was 90% higher and red blood cell folate was 55% higher in the highest HEI score group (above 80) when compared to the lowest HEI score group (below 50). Serum vitamin C was 148% higher while vitamin E was 21% higher. The carotenoids were 32 to 175% higher when the highest HEI score group was compared to the lowest score group (Weinstein et al., 2004).

The Healthy Eating Index was updated when the Dietary Guidelines for Americans 2005 was published (Guenther et al., 2008). The Index was edited to include moderation components, including alcohol, and it broke down the fruit and vegetable components to specify whole fruit, as well as dark green and orange vegetables, and legumes. Another update to the Healthy Eating Index was made in 2008 (Dixon, 2008). The Healthy Eating Index-05 is based on the same 10 components of the original HEI and uses the same scoring method. However, the requirements for the five food groups are based on estimated energy levels and activity levels (sedentary, moderately active, and active for both men and women and further divided into ages (younger or older than 50 years) (Dixon, 2008).

The national average for the Healthy Eating Index in 2004 was 63.2 (classified as 'needs improvement'). Approximately 18% of the population was scored as having poor diets (HEI 50 or below). Lower HEI scores are associated with lower income and lower education level (Guo et al., 2004, Beydoun and Wang, 2008). HEI scores are shown to increase with age, education, and income levels (Drewnowski and Specter, 2004, Bowman and Vinyard, 2004, Beydoun and Wang, 2008). Lower HEI scores are also related to obesity in both men and women (Nicklas et al., 2001, Schroder et al., 2006, Beydoun and Wang, 2008).

SNAP Participation and BMI

The higher obesity rates in low-income populations have caused some researchers to examine the association between food assistance programs and effect on BMI (Ver Ploeg et al., 2007, Townsend et al., 2001, Leung et al., 2012, Jilcott et al., 2011). Because most food insecure households receive food assistance of some kind, the role the programs themselves play in the obesity paradox has been questioned (Townsend et al., 2001). Some have found no association, as obesity is on the rise for the whole population (Ver Ploeg et al., 2007). However, some studies show SNAP participation to be associated with obesity. Leung and Villamore (2012) found the prevalence of obesity was 30% higher in SNAP participants when compared to non-participants after adjusting for food insecurity and sociodemographic characteristics (Leung et al., 2012). However, in a study that examined a cross-sectional sample of SNAP women participants, BMI was positively correlated with food insecurity, but its negative effects were shown to decrease with increasing SNAP benefits (Jilcott et al., 2011). Research is inconclusive in this area.

Food Management Practices and Diet

Programs such as SNAP-ED and EFNEP strive to optimize Healthy Eating Index scores in participants through teaching them the skills they need to make healthy choices and provide healthy meals for their families. Nevertheless, managing food resources on a low-income budget can be a challenge. Learning food resource management practices can enable low-income populations to make the most of their food supply and ensure that their families receive wholesome meals on a regular basis. However, a decreased household budget can negatively affect nutrition status of the family (Kempson et al., 2002). In a study by Dinkins, the use of grocery lists, planning meals, comparing prices, using coupons, and stocking up on sale items were suggested as ways to improve nutritional status on a budget (Dinkins, 1997). In a study by Quan et al (2000), a survey and personal interviews were used to pinpoint how certain behaviors affected fruit and vegetable consumption of low-income mothers in the WIC program (Quan et al., 2000). Behaviors such as making grocery lists and planning meals were associated with higher fruit and vegetable intake. Teaching low-income families the knowledge that they need, as well as providing support, encouraging self-efficacy, and helping them cope with perceived barriers have also been shown to increase fruit and vegetable consumption in low-income participants (Havas and Treiman, 1998).

There is little research about how food management practices effect nutrient intake and HEI scores. One study by Hersey, et al, (2001) examined data on 957 participants in the 1996 National Food Stamp Program Survey (NFSPS) and 5159 female EFNEP participants from various counties throughout the US to study the effect of food shopping practices on diet quality. From the 1996 NFSPS, the researchers collected a

stratified sample of data on the food shopping practices of 2142 participants. The sub-sample completed a seven day food record. Subset participants were trained on how to record the food and instructed to keep grocery receipts and food labels. After the seven day period, the participants were interviewed to review the records. The food shopping practices that were examined were as follows: use a shopping list, look for grocery specials, comparison shop, use coupons, shop in different stores for different specials, and stock up on bargains. These practices were labeled as "careful food shopping practices." This study concentrated on the Behavior Checklist questions relating most to food shopping practices, specifically, "how often do you think about healthy food choices, plan meals ahead, use a grocery list, use nutrition facts to make food choices, compare prices before purchasing food, and run out of food before the end of the month?" The 24-hour recall data were assessed to examine nutrient intake at baseline.

From the NFSPS data, the researchers found a significant relationship between specific shopping practices and meeting Recommended Daily Allowances (RDAs) in a household. While Reference Daily Intake (RDIs) is now typically used as the standards for measuring nutrient intake, RDAs were used at the time this study was completed. Participants who looked for sales were significantly more likely to meet RDAs within the household. Similarly, participants who used coupons, shopping lists, and compared prices were significantly more likely to have high nutritional availability in the household. The two behaviors that were not statistically significant in NFSPS participants, were visiting different stores for specials, and stocking up during sales. Secondly, from the NFSPS data, the researchers looked at careful food shopping practices as a whole and the relationship with household nutrient availability. They found that careful food shopping

practices were significantly related to meeting nutrient needs within a household (Hersey et al., 2001). Participants who reported thinking about healthy options were significantly more likely to meet the RDA for vitamins C, A, B6, and iron. Planning meals ahead was associated with meeting the RDA for vitamin A, and using nutrition labels was significantly related to lower fat in the diet, but not associated with dietary fiber (Hersey et al., 2001).

Chapter Three: Methodology

This study was designed to examine the relationship between the use of food management practices and dietary scores in low-income SNAP-ED and EFNEP participants. County extension records were used to analyze the association between various food management practices and diet outcomes. SNAP-ED/EFNEP files that had complete data were accessed from the 2010-2011 year. The Healthy Eating Index and other diet data collected by SNAP-ED/EFNEP program assistants were used to measure diet outcomes, and the Behavior Checklist was used to measure food management behaviors.

Study Region

The study region was comprised of 57 counties in Kentucky, which represented a total of 892,152 people. At entry, participants were asked their age, highest level of education completed, race/ethnicity, household income, and the number of family members in their household. Table 1 displays the descriptive statistics observed in the 57 counties.

Table 1 - Descriptives of Counties serving Low-Income participants in KY, 2011

Table 1. Descriptives of Counties serving Low-Income participants in Kentucky, 2011		
N=57 Counties	Mean/Percentage	SD
N=1585 Individuals		
Percent of Counties Serving each Age Range		
30-50	100%	
50-59	86%	
60 and over	74%	
Highest Level of Education		
Less than 12th grade	94%	
High School Degree or GED	2%	
Some College	4%	
Household Income		
Less than 50,000	98%	
Greater than 50,000	2%	
Type of Residence		
Rural	80%	
Non-rural	20%	
Percent of Counties Serving each Race Category		
White	98%	
African American	62%	
American Indian	14%	
Asian	8%	
Healthy Eating Index Scores (HEI)		
Fruit (range 0.1-6.4)	2.43	0.19
Vegetable (range 1.1-8)	4.81	0.18
Meat and Bean (range 3.2-9.4)	6.72	0.17
Milk (range 1.3-6.9)	3.67	0.15
Grain (range 4.4-9.5)	7.37	0.15
Total Fat (range 3.1-8.5)	5.84	0.16
Saturated Fat (range 4-9.5)	6.32	0.15
Sodium (range 1.8-10)	6.67	0.25
Cholesterol (range 2.1-9.6)	7.9	0.19
Variety (range 1.8-9.1)	5.4	0.26
Total HEI (range 45-71)	57.16	0.77
Dietary Profile		
Calories (range 1200-3730)	1789	642
Carbohydrate grams (range 109-556)	231	11.67
Total Fat grams (range 37-149)	72.67	3.19
Protein grams (range 31-123)	66.74	2.43
Fiber grams (range 5.2-45.2)	12.78	5.99

Rural and urban settings were both represented, (approximately 80% rural and 20% urban). Of the population represented, 88% was white. Median household income was $42,736. This study was exempt from the Internal Review Board since it was the

analysis of secondary data with individual level data combined and represented by county.

Study Sample

The participants were low-income families who were enrolled in the SNAP-ED or EFNEP programs. Existing data for the Kentucky families participating in SNAP-ED or EFNEP during the 2010-2011 year were used. Low-income families were recruited through local county extension agencies, SNAP benefit offices, health departments, and commodity distribution programs.

Eligibility and Enrollment

Low-income families must receive SNAP benefits or be eligible for SNAP participation. Low-income families are enrolled in the Nutrition Education Program for a maximum of twelve months. Adults receive six educational lessons before graduation, at which evaluation data are collected. The inclusion criterion was age 18 and older with complete information for all variables.

Research Instruments

The Healthy Eating Index was used to measure the overall diet quality. SNAP-ED and EFNEP use the original Healthy Eating Index components to measure diet quality. Other diet variables (total calories, carbohydrates, protein, fat, fiber, servings of fruits, vegetables, milk, meats and beans) are also used to reflect aspects of diet. Data was collected by SNAP-ED/EFNEP program assistants and calculated using NutWin Software (NutWin, 2012).

Figure 2 - Behavior Checklist Questionnaire

For these questions, think about how you usually do things. Please put a check in the box that best answers each question.	Not applicable 0	Do not Do 1	Seldom 2	Sometimes 3	Most of the time 4	Almost Always 5
1. How often do you plan meals ahead of time?						
2. How often do you compare prices before you buy food?						
3. How often do you run out of food before the end of the month?						
4. How often do you shop with a grocery list?						
5. When deciding what to feed your family, how often do you think about healthy food choices?						
6. How often do you use the "Nutrition Facts" on the food label to make food choices?						

The Behavior Checklist is a unique tool initially utilized by EFNEP and SNAP-Ed and is composed of 10 items that correspond with the nutrition education lessons. The purpose of the Behavior Checklist is to assess food and nutrition-related behaviors of SNAP-ED and EFNEP participants in a straight-forward, brief manner, and to provide feedback about the effectiveness of the SNAP-ED/EFNEP nutrition education lessons for staff and stakeholders (Anliker, 2003). The Behavior Checklist was originally developed to evaluate behaviors that could not be assessed through diet recall and other means (Anliker, 2003). Nationwide, EFNEP program assistants were called upon to contribute to the Behavior Checklist. Some behavior instruments were already being used, so the Checklist subcommittee used the information from existing instruments and input from

EFNEP program assistants to develop the Behavior Checklist, using the following domains: improve diet quality, improve management of food resources, improve food handling practices and food preparation skills, and increase mastery of living situation/self-esteem (Anliker, 2003). The questions in the checklist were developed at a 6th grade reading level. Validity and reliability of the Behavior Checklist were confirmed (Anliker, 2003). A final revision of the Behavior Checklist was released in 1996 with ten questions. The final ten questions cover food resource management practices, such as planning meals, comparing prices, risk of running out of food, and the use of grocery lists. Food safety practices are also covered. The other questions cover nutrition practices such as striving to provide healthy food choices for the family, preparing foods without salt, reading labels, and feeding children breakfast. Hoerr et al (2008) performed a factor analysis of the behavior checklist items in order to evaluate the effectiveness of the EFNEP program on promoting behavior change in its participants (Hoerr et al., 2011). Hoerr et al found that the greatest behavior change was in participants who received one-on-one nutrition education from the cooperative extension representative (Hoerr et al., 2011).

Covariates

The following covariates were collected by Cooperative Extension program assistants: age, race/ethnicity, education level, household income, and number in household. Covariates were grouped into categories to represent the characteristics of the individuals served in each county. Age groups included: under 17, 18-30, 30-50, 50-59, and 60 and over. Education levels represent the highest grade completed by the individual and included: less than 12th grade, high school degree or GED, and some college.

Household income levels included: less than $50,000, $50,000-$75,000, $76,000-$100,000, and greater than $100,000.

Counties were placed in the following categories based on type of residence: farm, towns under 10,000 and rural non-farm, towns and cities with 10,000 to 50,000 residents per square mile, suburbs of cities over 50,000 residents per square mile, and central city over 50,000 residents per square mile. Counties classified as rural included farm, rural non-farm, and 10,000-50,000 residents per square mile. Non-rural counties included over 50,000 residents per square mile or having a central city greater than 100,000 residents per square mile.

To analyze food management practices, the behavior checklist categories (do not do, seldom, sometimes, most of the time, and almost always) were organized into three main categories: 1) Never, which covered those who answered “do not do”, 2) Sometimes, which consists of the categories seldom or sometimes, and 3) Always, which consists of the categories most of the time and almost always.

Statistical Analysis

Statistical analysis was performed using Stata 12.1 (Stata, 2011). Descriptive statistics means and percentages were used to analyze the demographics of the sample population. Logistic regression and linear regression were used to determine the association between food management practices and dietary outcomes. A p-value of 0.05 or less was considered significant.

Chapter Four: Results

From the 57 counties used in this study, there were 1,585 individuals with pre- and post- program data available (Table 1). All of the counties served individuals between 30 and 50 years of age, 86% of the counties served individuals 50 to 59 years of age, and 74% served individuals who were 60 or older. Of the included counties, 94% served individuals whose highest level of education was less than the 12th grade. Only 2% served individuals with a high school degree or a GED, and 4% served individuals with some college education. The majority of counties (98%) served individuals a household income of less than $50,000 per year. The majority of counties served participants living in rural residences (80%). Out of the 57 counties, 98% of the counties served white participants, 62% served African Americans, 14% served American Indian, and 8% served Asian participants.

The mean HEI total for participants was 57.16 SD± 0.77, which falls into the "needs improvement" category (51-80). Mean calorie intake was 1789 SD± 642, mean carbohydrate intake was 231 SD± 11.67 grams, total fat intake was 72.67 SD± 3.19 grams, mean protein intake was 66.74 SD± 2.43, and mean fiber intake was 12.78 SD ±5.99.

Table 2a and 2b display how the food management behaviors affect the diet variables (adjusted for race, education, income, and population density (rural/urban). Table 3a and 3b display the unadjusted values.

Table 2a - Food Management Practices and HEI and Diet Components

	HEI Total	Calories	CHO(g)	Protein(g)	Fat(g)	Fiber(g)
Plan Meals						
Sometimes	2.32 (p=0.465)	-48.26 (p=0.888)	21.2(p=0.651)	-8.20 (p=0.397)	-10.70 (p=0.406)	1.48 (p=0.665)
Always	-1.39 (p=0.644)	-260.90 (p=0.425)	-13.01 (p=0.769)	-9.57 (p=0.297)	-11.08 (0.364)	-.16 (0.961)
Compare Prices						
Sometimes	-0.57(p=0.925)	1018.7 (p=0.112)	139.13 (p=.113)	22.74 (p=0.208)	43.9 (p=0.065)	2.4 (p=0.707)
Always	-3.16 (p=0.122)	-32.16 (p=0.879)	1.18 (p=0.967)	0.44 (p=0.941)	3.16 (p=0.685)	1.19 (p=0.578)
Grocery List						
Sometimes	5.55 (p=0.089)	833.73 (**p=0.011**)	136.46 (**p=0.002**)	15.22 (p=0.11)	29.78 (**p=0.017**)	7.53 (**p=0.023**)
Always	1.45 (p=0.6)	112.75 (p=0.678)	32.84 (p=0.364)	0.85 (p=0.916)	8.03 (p=0.441)	1.95 (p=0.482)
Healthy Food						
Sometimes	9.98 (**p=0.002**)	892.33 (**p=0.009**)	150.33 (**p=0.001**)	15.67 (p=0.105)	18.15 (p=0.157)	12.49 (**p=0.00**)
Always	2.48 (p=0.162)	71.3 (p=0.707)	-2.24 (p=0.926)	-0.62 (p=0.911)	-3.12 (p=0.672)	1.78 (p=0.297)
Read Labels						
Sometimes	Omitted*	830.99 (p=0.156)	108.9 (p=0.168)	21.87 (p=0.211)	42 (p=0.068)	9.46 (p=0.128)
Always	-1.06 (p=0.545)	315.26 (p=0.587)	34.44 (p=0.659)	14.4 (p=0.407)	28.62 (p=0.208)	7.11 (p=249)
Run Out of Food						
Sometimes	-.77 (-=0.862)	-354.5 (p=0.436)	-98.65 (p=.112)	10.83 (p=0.397)	-2.92 (p=0.866)	3.39 (p=0.463)
Always	-3.6 (0.409)	-711.4 (p=0.118)	-137.38 (p=0.027)	0.29 (p=0.981)	-12.20 (p=0.477)	0.64 (p=0.888)

All models adjusted for race, education, income, and population density.
Significance Level- α=0.05
Reference=Never
Always= Responses of 'Most of the Time' or 'Almost Always' on the Behavior Checklist.
Sometimes= Responses of 'Seldom' or 'Sometimes' on the Behavior Checklist.
*Omitted due to insufficient cell size

Table 2b - Food Management Practices and Servings of Fruit, Vegetables, Milk, Meats/Beans

	Fruit	Vegetables	Milk	Meats/Beans
Plan Meals				
Sometimes	-.16 (p=0.343)	0.44 (p=0.468)	-0.32 (p=0.225)	-0.15 (p=0.798)
Always	-.20 (p=0.206)	0.06 (p=0.92)	-.52 (**p=0.043**)	-0.04 (p=0.943)
Compare Prices				
Sometimes	-0.42 (p=0.183)	0.62 (p=0.588)	0.05 (p=0.916)	1.57 (p=0.158)
Always	-0.1 (p=0.351)	0.22 (p=0.565)	-0.08 (p=0.656)	-0.13 (p=0.734)
Grocery List				
Sometimes	0.04 (p=0.805)	1.24 (**p=0.038**)	0.16 (p=0.548)	0.51 (p=0.405)
Always	-0.12 (p=0.421)	0.28 (p=0.576)	-0.27 (p=0.246)	0.2 (p=0.704)
Healthy Food				
Sometimes	0.42 (**p=0.012**)	2.14 (**p=0.00**)	0.25 (p=0.366)	0.3 (p=0.623)
Always	0.12 (p=0.206)	0.26 (p=0.41)	-0.15 (p=0.344)	0.12 (p=0.736)
Read Labels				
Sometimes	-0.16 (p=0.599)	1.66 (p=0.134)	-1.22 (**p=0.019**)	2.73 (**p=0.016**)
Always	-0.08 (p=0.801)	1.21 (p=0.271)	-1.26 (**p=0.015**)	2.43 (**p=0.03**)
Run Out of Food				
Sometimes	0.23 (p=0.328)	0.69 (p=0.389)	0.64 (p=0.063)	0.18 (p=0.831)
Always	0.19 (p=0.419)	0.14 (p=0.865)	0.24 (p=0.478)	-0.07 (p=0.925)

All models adjusted for race, education, income, and population density.
Significance Level- α=0.05
Reference=Never
Always= Responses of 'Most of the Time' or 'Almost Always' on the Behavior Checklist.
Sometimes= Responses of 'Seldom' or 'Sometimes' on the Behavior Checklist.

Table 3a - Food Management Practices and HEI and Diet Components (Unadjusted Models)

	HEI Total	Calories	CHO	Protein	Fat	Fiber
Plan Meals						
Sometimes	1.55 (p=0.57)	-197.49 (p=0.517)	-2.40 (p=0.954)	-10.47 (0.235)	-14.45 (p=0.211)	-0.14 (p=0.961)
Always	-1.36 (p=0.593)	-407.75 (p=0.155)	-39.64 (p=0.312)	-11.71 (p=0.156)	-16.40 (p=0.129)	-1.77 (p=0.511)
Compare Prices						
Sometimes	-1.61 (p=0.71)	88.38 (p=0.858)	20.58 (p=0.761)	-1.84 (p=0.897)	0.54 (p=0.977)	-3.81 (p=0.41)
Always	-2.99 (p=0.097)	-154.58 (p=0.445)	-19.2 (p=0.471)	-3.38 (p=0.561)	-3.06 (p=0.688)	-0.40 (p=0.831)
Grocery List						
Sometimes	5.52 (p=0.065)	837.12 (**p=0.01**)	134.46 (**p=0.002**)	16.6 (p=0.081)	29.66 (**p=0.016**)	7.02 (**p=0.021**)
Always	2.08 (p=0.373)	167.36 (p=0.5)	32.27 (p=0.33)	3.45 (0.642)	7.97 (p=0.4)	1.45 (p=0.537)
Healthy Food						
Sometimes	8.98 (**p=0.002**)	810.9 (p=0.012)	132.12(**p=0.002**)	16.92 (p=0.071)	18.29 (p=0.136)	11.14 (**p=0.00**)
Always	2.11 (p=0.188)	23.89 (p=0.859)	-11.15 (p=0.638)	-0.34 (p=0.95)	-3.52 (p=0.619)	1.38 (p=0.416)
Read Labels						
Sometimes	5.11 (p=0.236)	997.63 (**p=0.025**)	140.1 (**p=0.019**)	25.95 (p=0.054)	38.84 (**p=0.024**)	7.37 (p=0.095)
Always	3.82 (p=0.367)	461.75 (p=0283)	59.39 (p=0.303)	17.66 (p=0.18)	23.72 (p=0.157)	4.82 (p=0.264)
Run out of Food						
Sometimes	-2.15 (p=0.499)	-349.69 (p=0.316)	-84.33 (0.074)	1.5 (p=0.882)	-6.85 (p=0.609)	1.44 (p=0.668)
Always	-4.88 (p=0.107)	-700.37 (p=0.036)	-127.18 (**0.005**)	-9.11 (p=0.342)	-16.93 (p=0.183)	-1.53 (p=0.63)

Unadjusted Models
Significance Level- α=0.05
Reference=Never
Always= Responses of 'Most of the Time' or 'Almost Always' on the Behavior Checklist.
Sometimes= Responses of 'Seldom' or 'Sometimes' on the Behavior Checklist.

Table 3b - Food Management Practices and Servings of Fruit, Vegetables, Milk, Meats/Beans (Unadjusted Models)

	Fruit	Vegetables	Milk	Meats/Beans
Plan Meals				
Sometimes	-0.25 (p=0.093)	0.29 (p=0.559)	-0.26 (p=0.287)	-0.44 (p=0.449)
Always	-0.22 (p=0.102)	-0.09 (p=0.838)	-0.37 (p=0.102)	-0.38 (p=0.483)
Compare Prices				
Sometimes	-0.27 (p=0.248)	-0.43 (p=0.59)	0.55 (p=0.156)	-0.84 (p=0.361)
Always	-0.10 (p=0.319)	0.02 (p=0.944)	-0.12 (p=0.443)	-0.32 (p=0.396)
Grocery List				
Sometimes	0.06 (p=0.692)	1.2 (**p=0.022**)	0.22 (p=0.407)	0.56 (p=0.373)
Always	-0.002 (p=0.985)	0.2 (0.619)	-0.12 (p=0.553)	0.3 (p=0.544)
Healthy Food				
Sometimes	0.35 (**p=0.027**)	1.87 (**p=0.00**)	1.03 (p=0.346)	0.65 (p=0.291)
Always	0.11 (p=0.211)	0.22 (0.416)	13.69 (p=0.212)	0.23 (p=0.518)
Read Labels				
Sometimes	-.01 (p=0.968)	1.23 (p=0.104)	-0.4 (p=0.298)	2.37 (**p=0.006**)
Always	0.08 (p=0.723)	0.78 (p=0.29)	-0.45 (p=0.231)	2.01 (**p=0.018**)
Run out of Food				
Sometimes	-0.03 (p=0.86)	0.54 (p=0.348)	-0.01 (p=0.981)	0.11 (p=0.876)
Always	0.03 (p=0.842)	-0.05 (p=0.922)	-0.39 (p=0.127)	-0.18 (p=0.779)

Unadjusted Models
Significance Level- α=0.05
Reference=Never
Always= Responses of 'Most of the Time' or 'Almost Always' on the Behavior Checklist.
Sometimes= Responses of 'Seldom' or 'Sometimes' on the Behavior Checklist.

As shown in Tables 2a and 2b, participants who always planned meals consumed 0.52 (p=.043, [95% CI -1.02, 0.02]) less servings of milk on average when compared to those participants who never planned meals. Those who sometimes shopped with a grocery list consumed, on average, 833.73 (p=.011,[95% CI 200.08, 1467.39]) more calories, 136.46 (p=.002, [95% CI 52.43, 220.49]) more grams of carbohydrates, 29.78 (p=.017, [95% CI 5.55, 54.01]) more grams of fat, 7.53 (p=.023, [95% CI 1.07, 13.99]) more grams of fiber, and 1.24 (.038, [95% CI 0.07, 2.40]) cups more vegetables, than those who never shopped with a grocery list. Participants who sometimes thought about healthy food when deciding what to feed their families had HEI total scores that were 9.98 (p=.002, [95% CI 3.97, 15]) points higher on average than those who never thought about healthy foods. Additionally, those who sometimes thought about healthy foods to feed their families consumed, on average, 892.33 (p=.009, [95% CI 238.49, 1546.21]) more calories, 150.33 (p=.001, [95% CI 66.96, 233.69]) more grams of carbohydrates, 12.49 (p=.00, [95% CI 6.63, 18.36]) more grams of fiber, 0.42 (p=.012, [95% CI 0.10,0.74]) cups more fruit, and 2.14 (p=.00, [95% CI 1.07, 3.2]) cups more vegetables, compared to those who never considered healthy foods when deciding what to feed their families. Participants who sometimes read labels consumed 1.22 (p=.019, [95% CI -2.23,-0.21]) fewer servings of milk and 2.73 (p=.016, [95% CI 0.54, 4.91]) more servings of meat and beans on average compared to those who never read labels. Similarly, participants who always read labels consumed 1.26 (p=0.015, [95% CI -2.27, -0.25]) fewer servings of milk and 2.43 (p=.03, [95% CI 0.25, 4.61]) more servings of meat and beans on average when compared to those who never read labels. Participants who responded that they always ran out of food before the end of the month consumed 137.38 (p=.027, [95% CI -

258.61, -16.16]) fewer grams of carbohydrates on average compared to those who did never ran out of food.

The unadjusted models are displayed in Tables 3a and 3b. For the variable 'plan meals,' no significance is shown in the unadjusted model. In the adjusted model, planning meals decreased milk intake by approximately 1/2 cup. Like the adjusted model, the unadjusted model shows no significance between the variable 'compare prices' and the diet outcomes. Similarly, for the variable 'grocery list,' the same diet outcomes are significant in both models (calories, carbohydrates, fat, fiber, and vegetables). Furthermore, the unadjusted model and adjusted models are very similar for the variable 'healthy food,' with significant values for HEI total, calories, carbohydrates, fiber, fruit, and vegetables. For the variable 'read labels,' calories, carbohydrates, and fat become significant in the unadjusted model, while milk is no longer shown to be significant and meats and beans remain significant in both models. In the unadjusted model, the participants who sometimes read labels were shown to consume on average 997.63 (p=.025, [95% CI 32.28, 1862.98]) more calories, 140.1 (p=.019, [95% CI 23.99, 256.22]) more grams of carbohydrates, and 38.84 (p=.024, [95% CI 5.22, 72.56]) grams of fat when compared to those who never read labels. Lastly, the variable 'run out of food' was mostly the same in both models, except that calories became significant in the unadjusted model. The unadjusted model indicated that those who always ran out of food before the end of the month consumed, on average, 700.37 (p=.036, [95% CI -1353.21, -47.5]) fewer calories than those who never ran out of food before the end of the month.

Chapter Five: Discussion

The results of this analysis suggest that food management practices and healthy eating behaviors can help low-income SNAP-ED and EFNEP participants obtain more food for their families. However, although the participants may have been able to purchase more foods by good food management practices, it seems that they did not always choose nutritious foods to buy. It would appear that in addition to the slight increase in fruits, vegetables, and nutrient-dense foods, there was also a significant increase in calorie-, carbohydrate-, and fat-dense foods. Total calories, total carbohydrates, and total fat increased considerably on average in participants who practiced the food management behaviors. Since this low-income population is food insecure, an increase in calories, fat, and carbohydrates would be desirable, as long as a significant improvement in diet quality accompanies this increase. Food management skills should increase food procurement and intake while maximizing the Healthy Eating Index and dietary scores.

The effect of the obesity paradox can be perceived in the data. For example, for the variable 'grocery list,' there was a large increase in calorie, carbohydrate, and fat intake. It is clear that the food management skill helped participants obtain more food compared to those who never practiced the skill. However, there was not an increase in fruits, milk, or meats and beans. There was a very small increase in vegetable intake, but it is important to realize that the increase could be from any vegetable subgroup (likely starchy) since the original HEI variables are used. Since the added calories, carbohydrates, and fat are not a result of additional servings from these food groups, they must be a result of more energy-dense foods. The participants seemed to purchase the

less-expensive energy-dense foods over the nutrient-dense foods that may have been more expensive. Thus, the obesity paradox is displayed.

From the adjusted and unadjusted models, using a grocery list and thinking about healthy foods when planning what to feed the family were the only two variables that were shown to improve diet outcomes in both models. This suggests that these food management practices are effective in improving self-reported diet outcomes among low-income participants regardless of race, education level, income level (degree of low-income), and population density.

The only food management variable that resulted in higher HEI totals was "healthy foods." The near 10 point increase in HEI seen as a result of thinking about healthy foods when planning meals for family still puts those low-income participants in the "needs improvement" HEI category (approximately 67), but this score is more comparable with the national average HEI score (Guo et al., 2004). While there was an increase in total calories and carbohydrates (but not fat), there was also an increase in fiber (12g), fruits (almost ½ cup), and vegetables (over two cups). It is this food management skill that has the potential to be used in an intervention that addresses nutritional disparities in low-income populations.

Few studies have examined the association between food management practices and diet quality. The most similar study was conducted by Hersey et al, (2001) which examined food shopping practices and diet quality in low-income households (Hersey et al., 2001). Thinking about healthy options was shown to increase the odds of meeting household RDAs for vitamins C, A, B6, and iron. Planning meals ahead was associated with meeting the household RDAs for vitamin A, and using nutrition labels was

significantly related to lower fat in the diet, but not associated with dietary fiber. In the current study, thinking about healthy foods when deciding what to feed the family was related to improved HEI scores which can be compared to the household RDAs. This variable may be the most effective at improving overall diet because it combines food management and nutrition education skills.

In a separate study that examined attitudes of food shoppers when purchasing food, it was found that those who valued the importance of nutrition when purchasing food for their families consumed more fruits, non-starchy vegetables and milk, and consumed less total calories than those who did not consider nutrition important when purchasing foods (Bowman, 2005). This result is also comparable to the current study's variable "healthy foods."

It would seem that the food management practices in general are only leading to an increase in the foods purchased and consumed by the participants, with little increases in servings of fruits and vegetables, fiber, and HEI scores. Based on this information, it may be a better approach to focus on nutrition education for this population, while teaching them to think about healthy foods when planning and shopping for their families. This is supported by another study by Beydoun and Wang, who examined social-economic status, perceived barriers of food price, and perceived benefit of diet quality on diet outcomes. The authors state that, "promoting positive attitudes towards the benefits of healthy diets can be effective in improving diet quality in the whole population for both genders and all ethnicities (Beydoun and Wang, 2008) p312. Since low-energy, higher quality diets are more expensive, the food management aspect will still be important, yet low-income populations need guidance on choosing healthy foods.

It seems that it will take a more integrated approach to get the focus off of just food procurement and to encourage low-income participants to consider the nutrition of the foods they buy. It is also important to recognize that education may be needed on purchasing and preparing vegetables. Healthy recipes, cooking demonstrations, and tips for cooking healthy are also ways that may help to increase diet quality.

Policy

There have been several studies examining the obesity paradox and food stamps, and policy changes have been proposed by researchers to help alleviate this phenomenon. Some researchers have proposed interventions that teach budgeting principles to help participants avoid running out of food before the end of the month ((Bhargava, 2004, Wilde, 2000). Education on budgeting principles was recommended in addition to a restructuring of the allocation of benefits from monthly to weekly (Perez-Escamilla et al., 2000). The current study supports the teaching of budgeting principles through food management practices and nutrition education. Other resources that could be combined with this approach include healthy recipes, meal plans/guides and grocery lists to reflect budget periods (weekly or bi-monthly), cooking demonstrations, and tips for nutrition and healthy cooking.

Other studies have proposed that a policy change take place allowing Food Stamp benefits to be used only on foods supported by the Dietary Guidelines for Americans in order to increase diet quality by cutting out energy-dense foods and increasing the amount of nutrient-dense foods (Townsend, 2006). A similar approach may be to base the amount of benefits allocated to participants on the age, gender, activity level and nutrient-

needs of participants. Benefits could be based on specific household requirements in order to encourage appropriate and healthful intake.

The 2008 Farm Bill provided funding for SNAP benefits to be used at Farmer's Markets, increasing the incentive to purchase nutrient-dense foods. The 2012 Farm Bill increased this funding, and there are now over 2,000 Farmer's Markets accepting SNAP benefits (United States Department of Agriculture, 2013). The 2008 Farm Bill also provided funding for the Senior Farmers' Market Nutrition Program, which provides coupons to low-income seniors to use for fruits, vegetables, honey, and herbs at Farmers' Markets, community- supported agriculture programs, and roadside produce stands. The goals of the program are to provide fresh, locally grown produce to low-income seniors and to support local farmers and farmer's markets, roadside stands, and community programs. Interventions that include policy change and provide incentives to purchase nutrient-dense foods can be successful in improving diet quality (United States Department of Agriculture, 2013).

Limitations

There are several limitations of this study. First, the cross-sectional design limits the ability to make causal inference, so only correlations can be inferred. Secondly, there is a possibility for under-reporting or over-reported for the dietary variables even though the participants worked with trained program assistants to maximize accuracy of dietary recall. Also, participants may not have answered the food management questionnaire accurately due to either question bias or misunderstanding. These limitations must be taken into consideration when interpreting and applying the results.

Implications

Current guidelines do not require EFNEP/SNAP-ED program assistants to teach lessons on food management. Lessons covering topics related to food management and healthy food procurement such as planning meals, using grocery lists, reading labels, and budgeting for food are optional, and at the discretion of Extension program assistants. Good food management practices have been shown to assist low-income populations in obtaining an adequate food supply. However, guidance and education are needed to instruct low-income participants on choosing healthy foods while making the most of their budget. An integrated approach to food management practices and nutrition education is needed to improve diet quality for low-income populations.

Recommendation for Future Studies

Further research is needed to determine the effectiveness of including food management practices in all nutrition education lessons for SNAP-ED/EFNEP participants. Long-term effects should also be studied for these participants. Further research is needed on the effect of food management practices on dietary outcomes of low-income populations, as well as how these practices can be combined with nutrition education to enable healthy food procurement and increased diet outcomes. More research should also be conducted on variables contributing to nutritional disparities of low-income populations. Perhaps further understanding more about the population will aid in effective intervention strategies.

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